R. A., C. H. & W. CASWELL.

BALING MACHINE.

APPLICATION FILED NOV. 4, 1907.

932,755.

Patented Aug. 31, 1909.

10 SHEETS—SHEET 1.

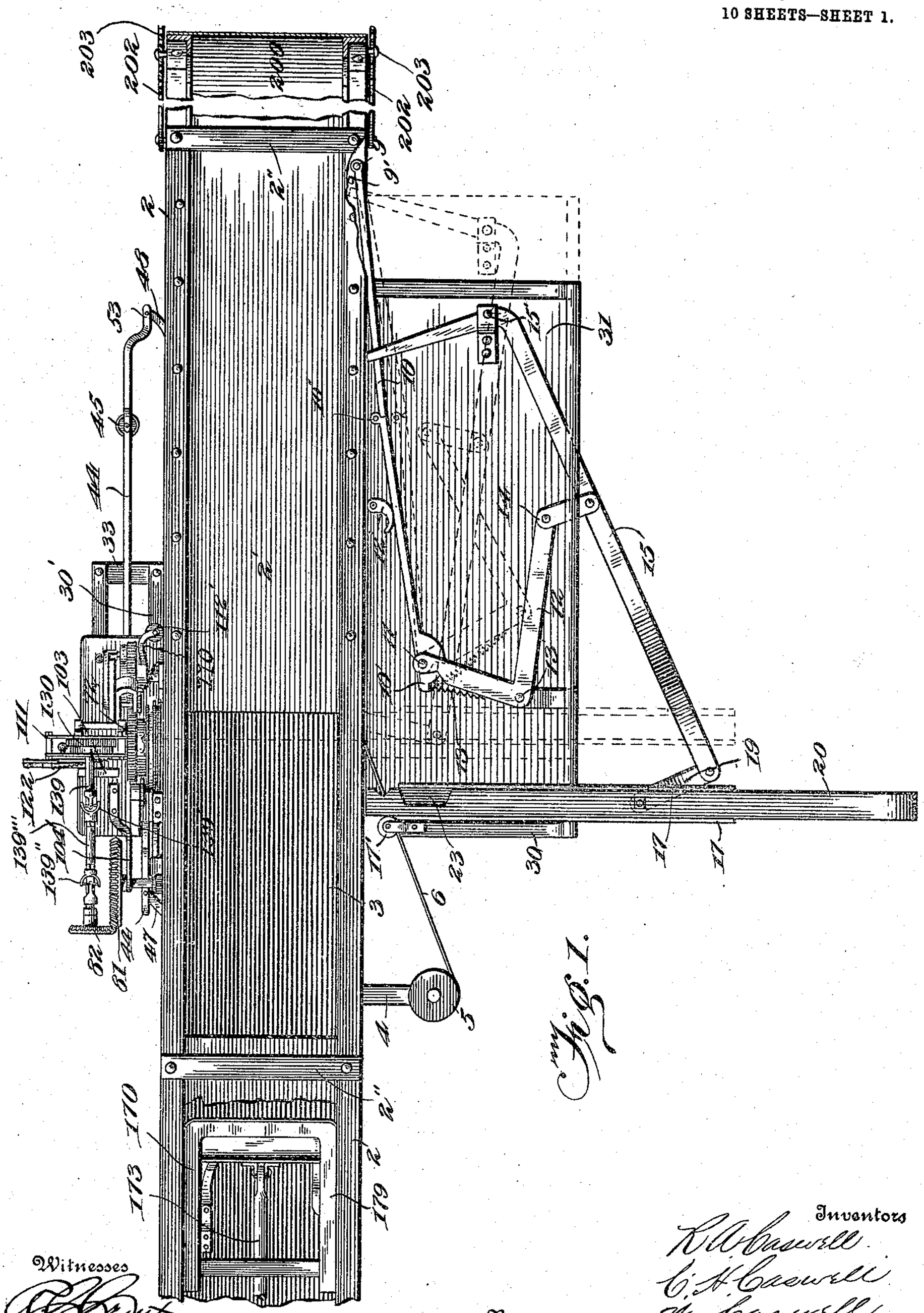

Fig. 1.

Witnesses

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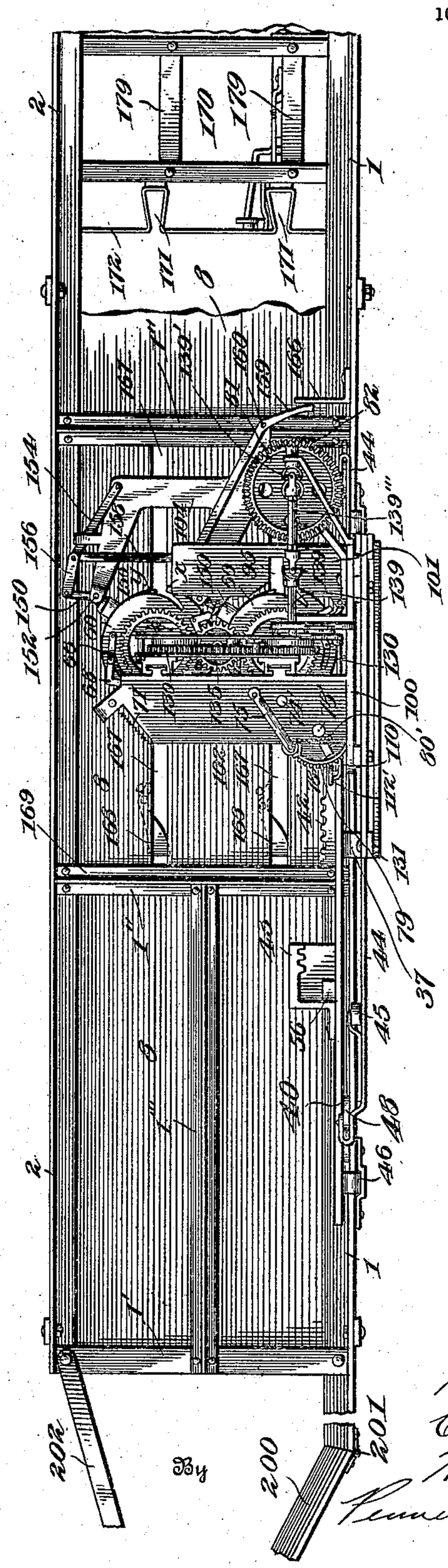

Fig. 2.

Witnesses

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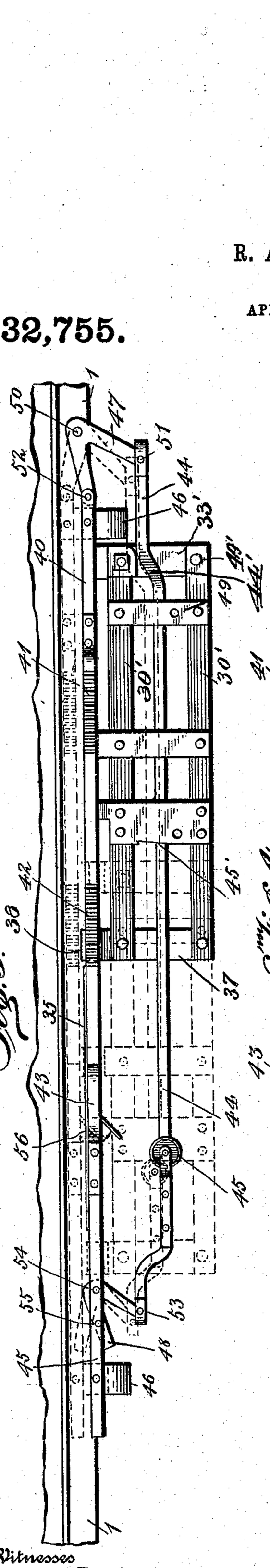

Fig. 3.

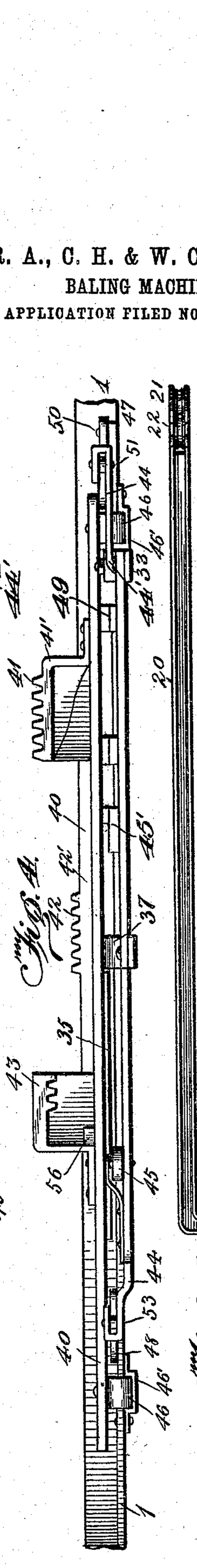

Fig. 4.

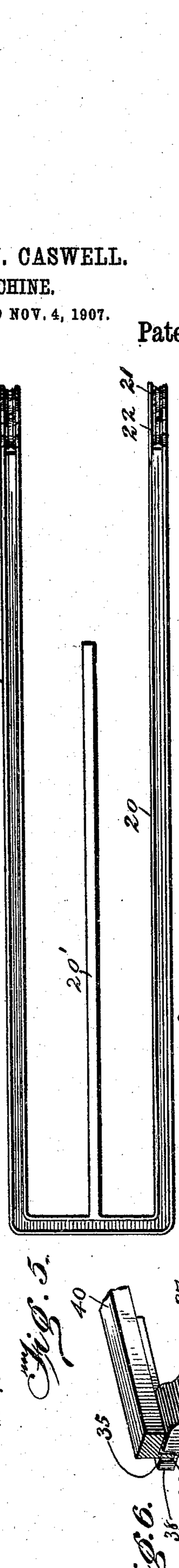

Fig. 5.

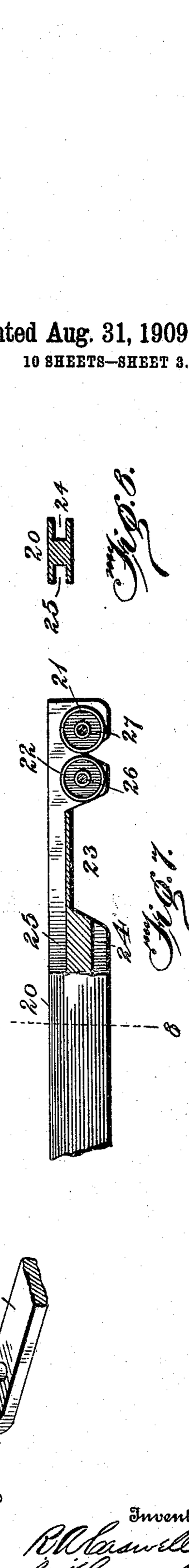

Fig. 6.

Fig. 7.

Witnesses

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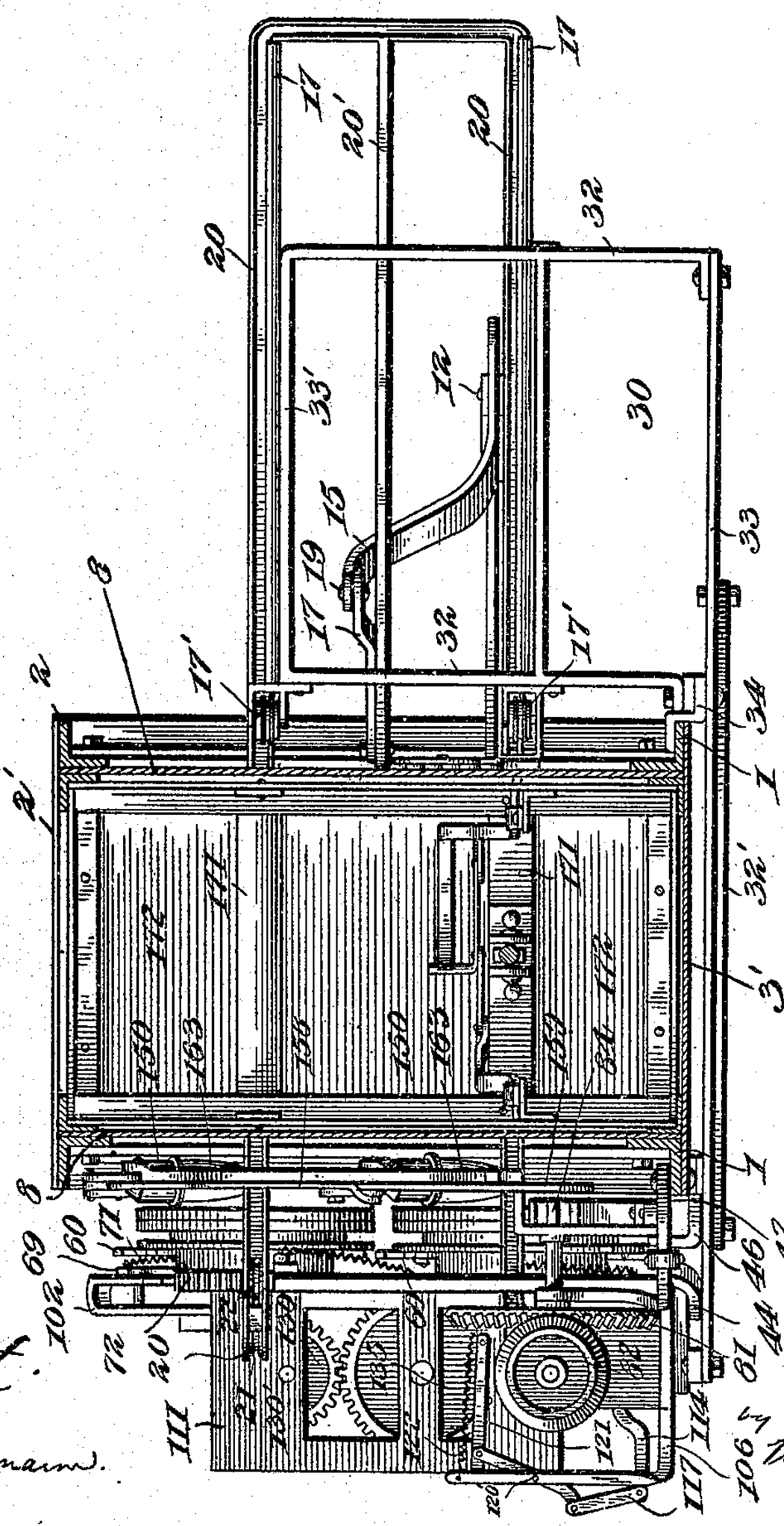
10 SHEETS—SHEET 4.

Fig. 9.



Witnesses

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ANDREW. B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

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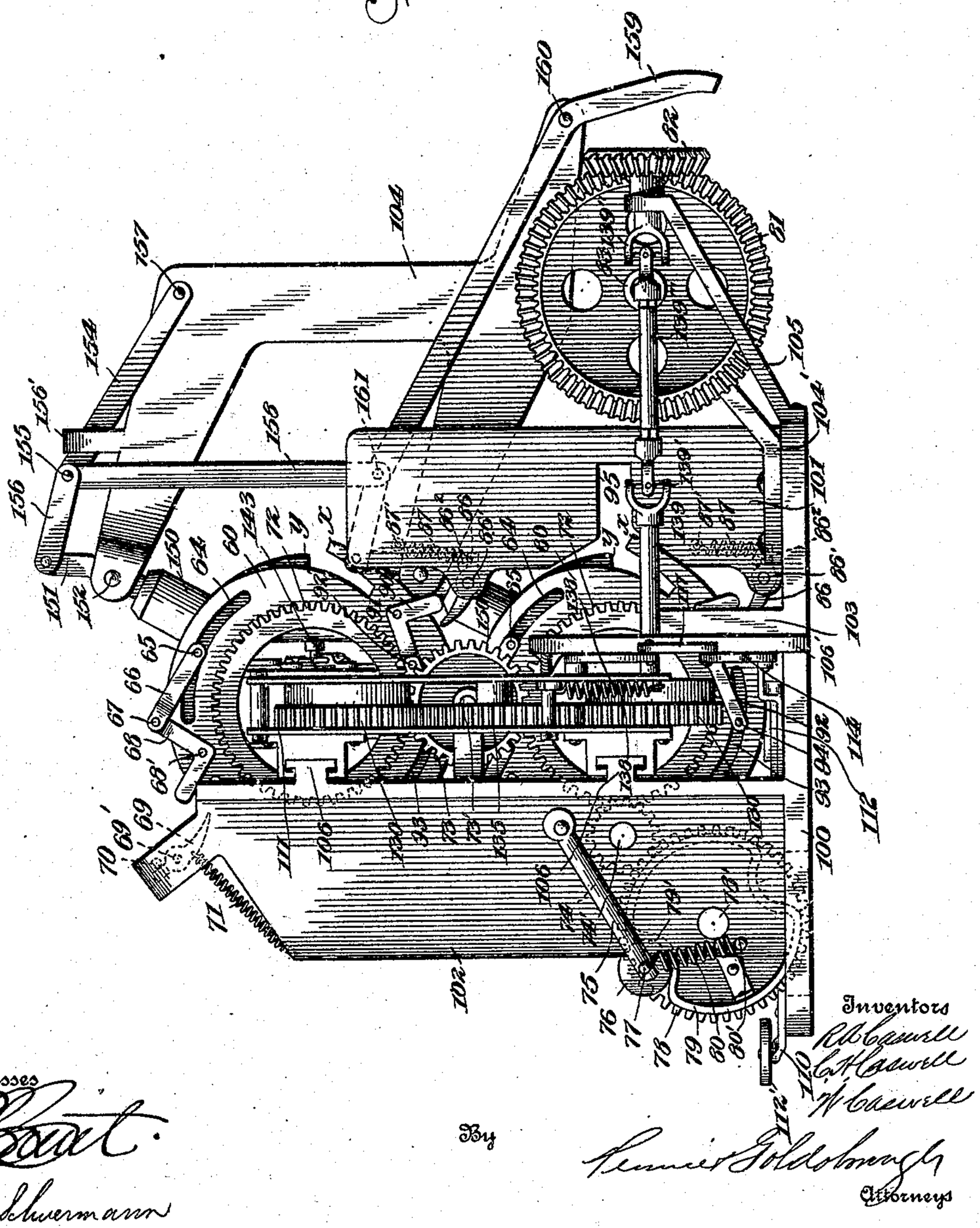
10 SHEETS—SHEET 5.

Fig. 10.



Witnesses

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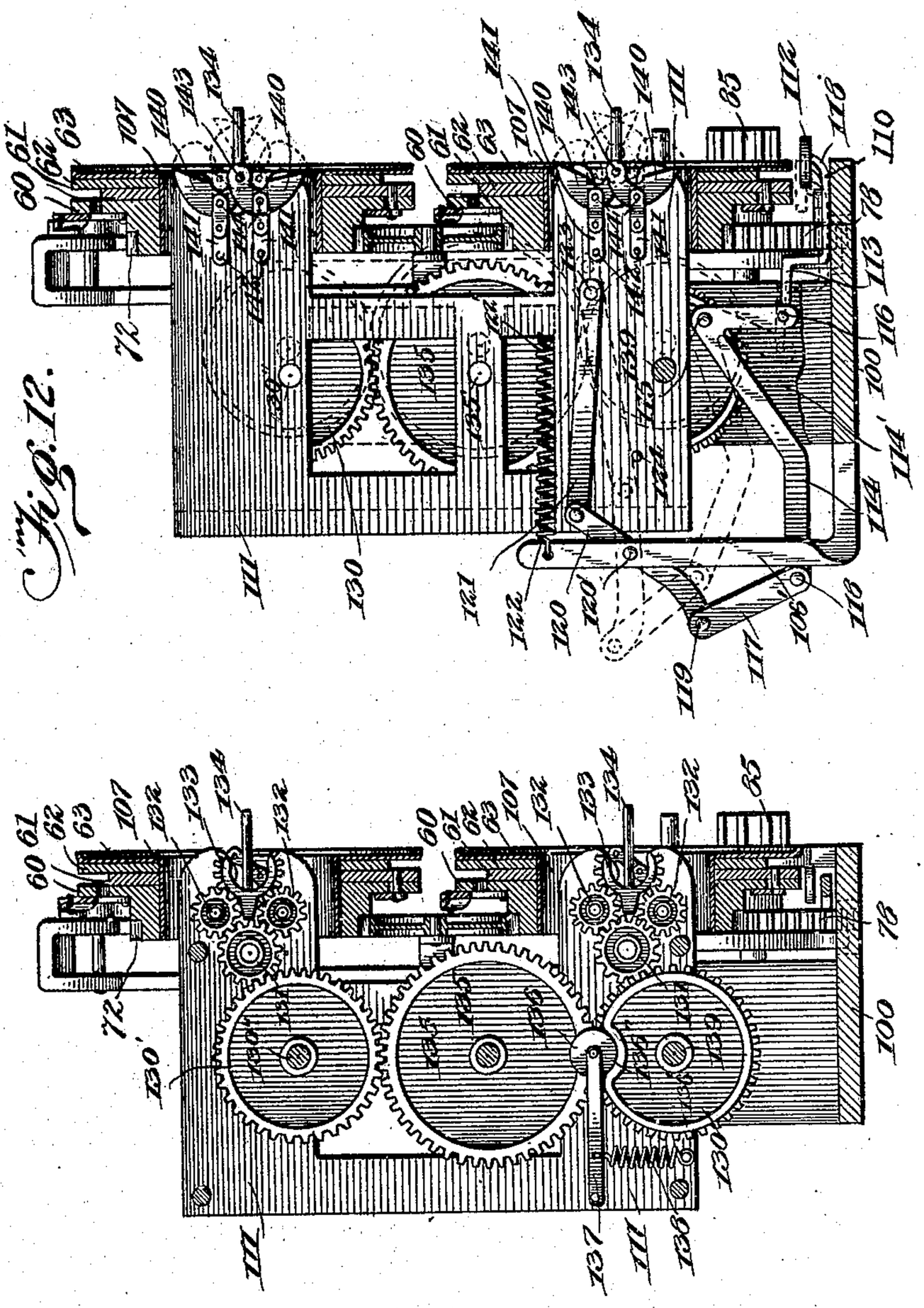

Fig. 12.

Fig. 11.

Witnesses:

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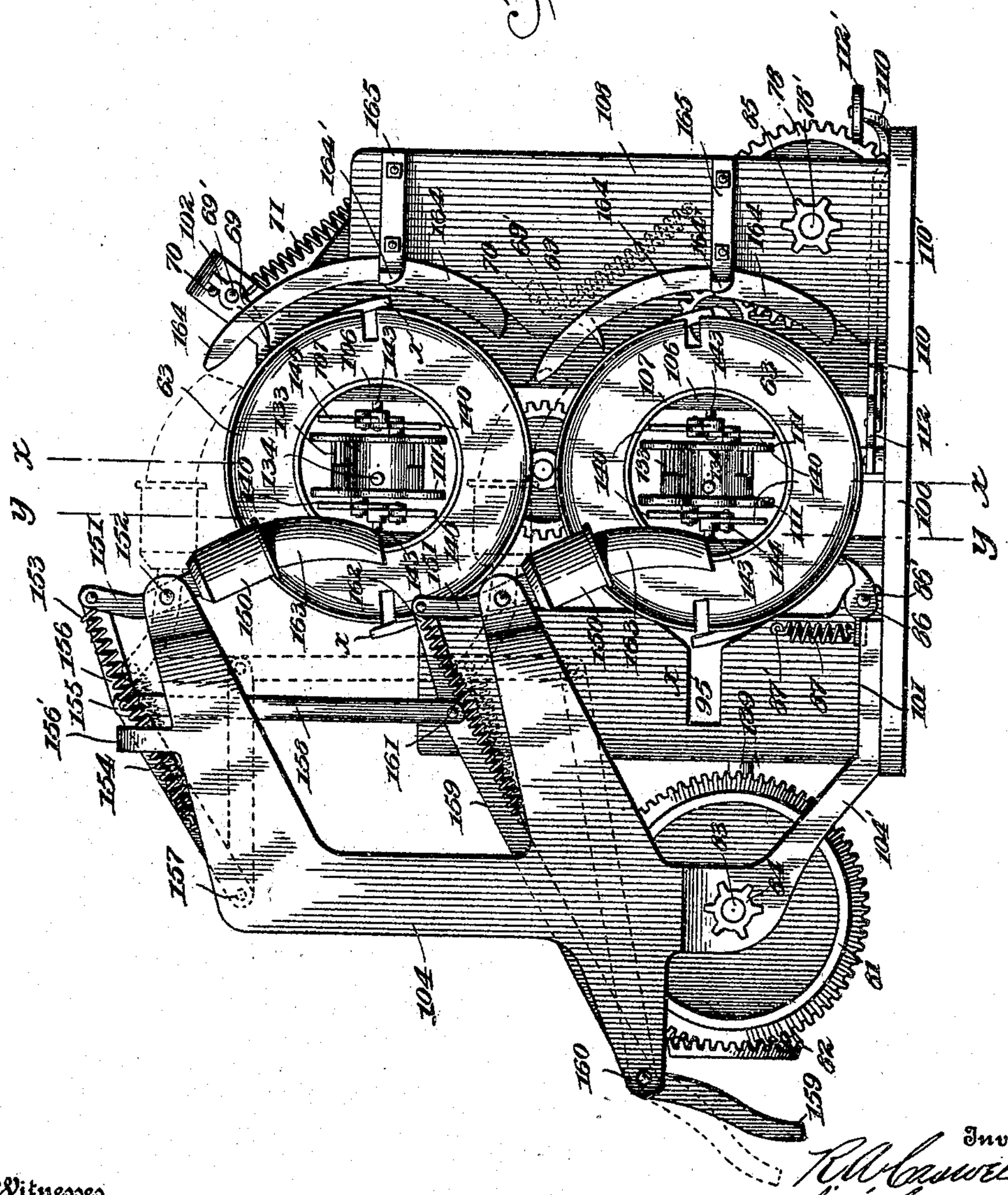
10 SHEETS—SHEET 7.

Fig. 13.



Witnesses

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E. C. Schuermann.

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10 SHEETS—SHEET 8.

Fig. 15.

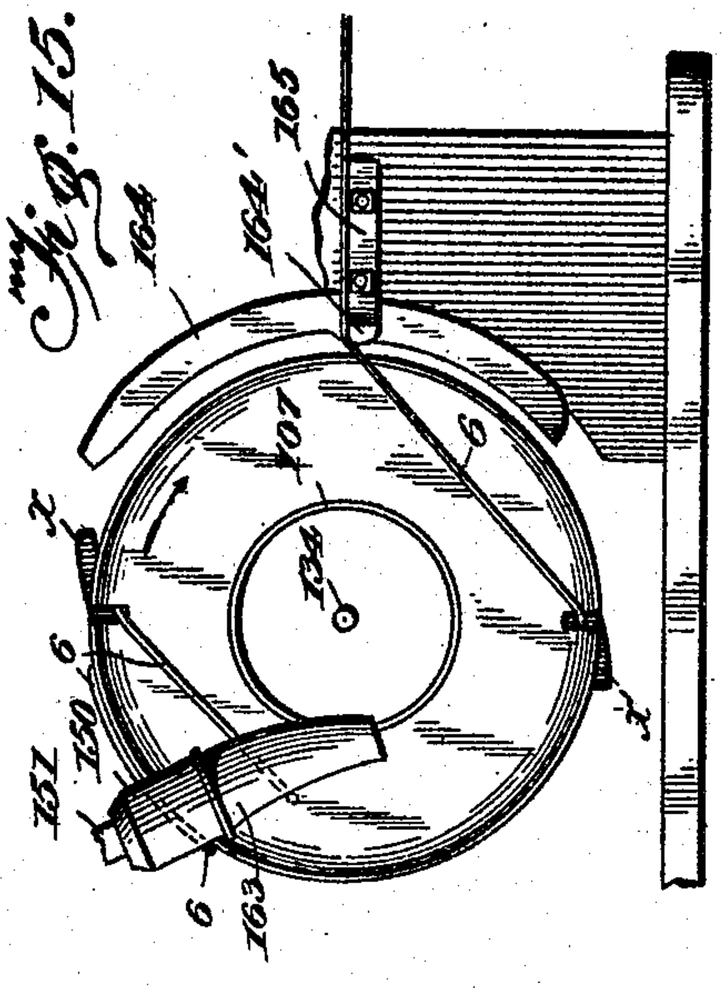


Fig. 17.

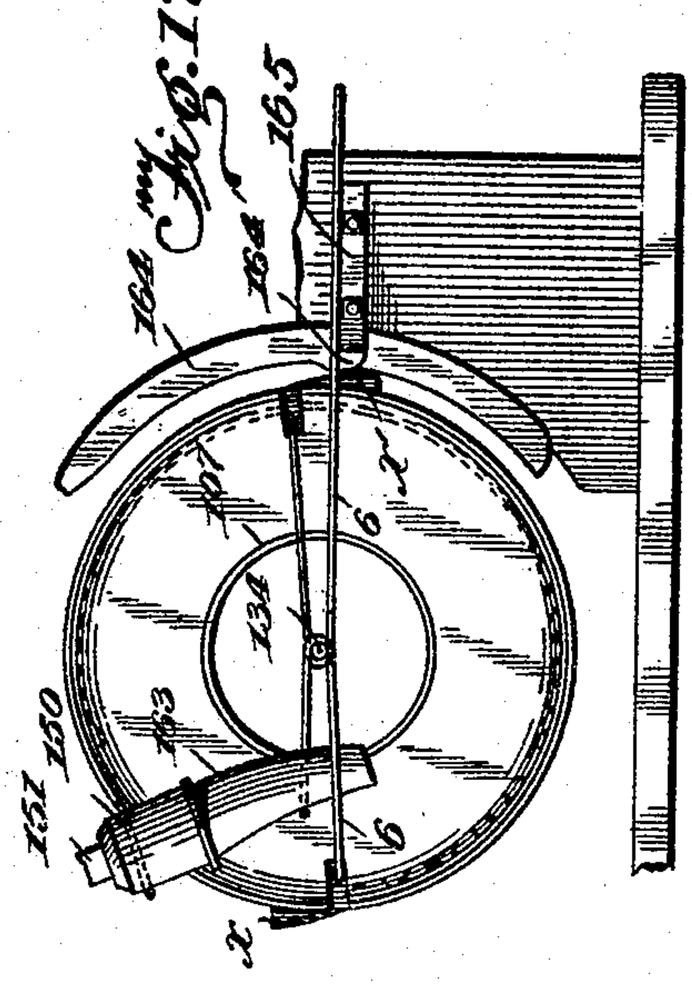


Fig. 14.

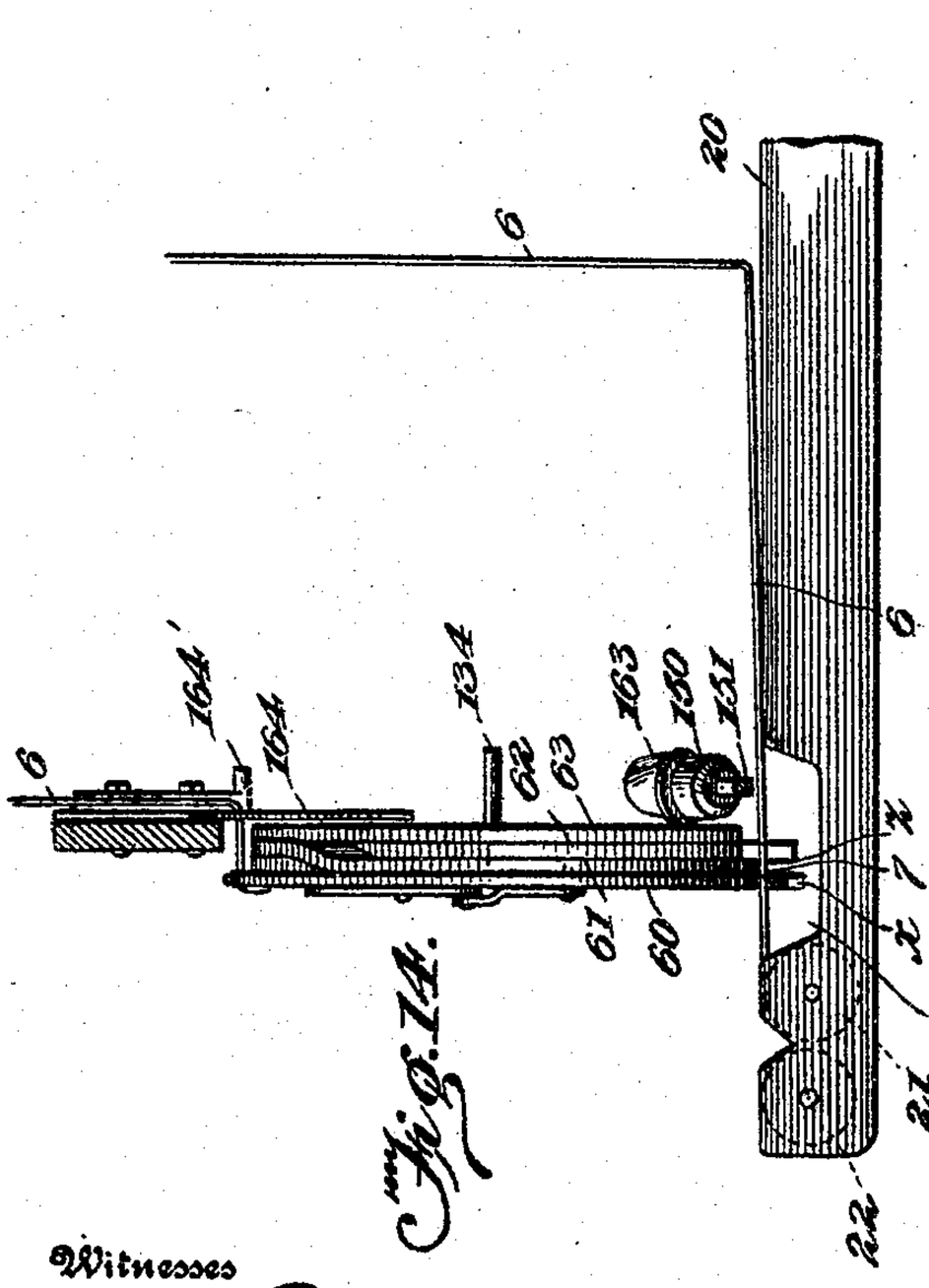
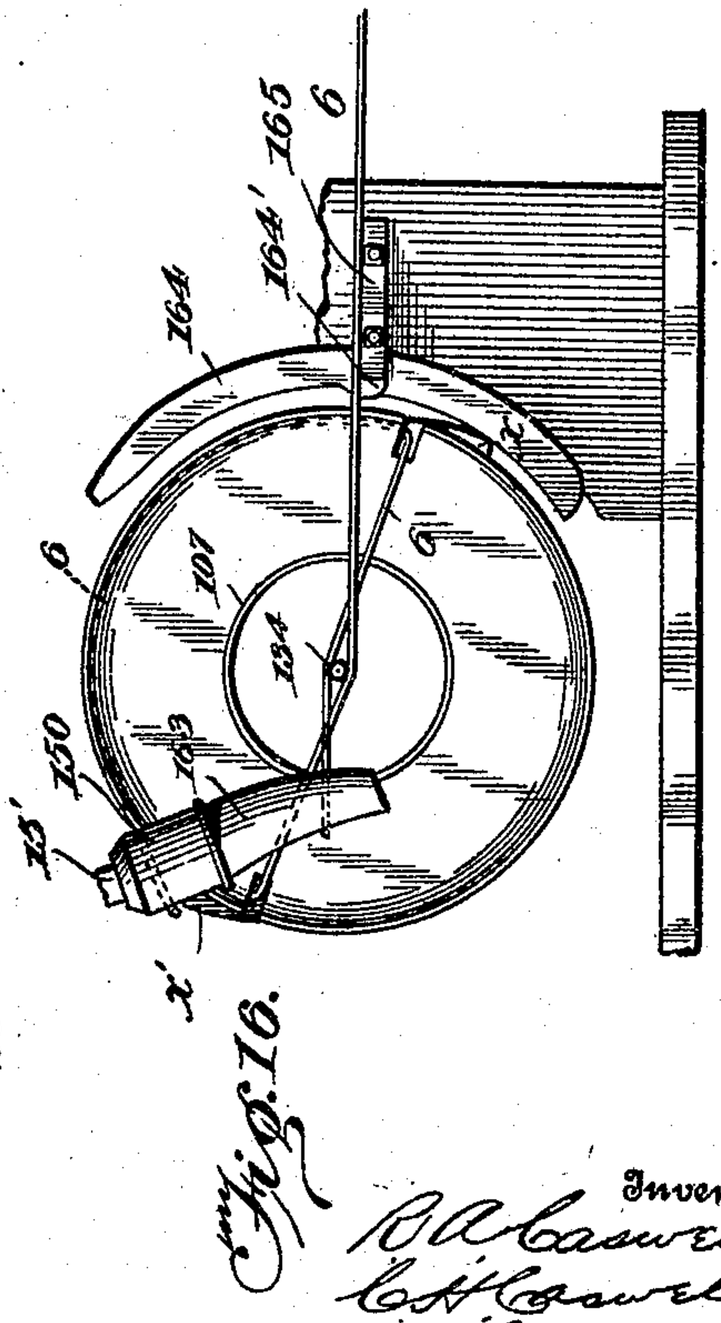


Fig. 16.



Witnesses

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10 SHEETS—SHEET 9.

Fig. 19.

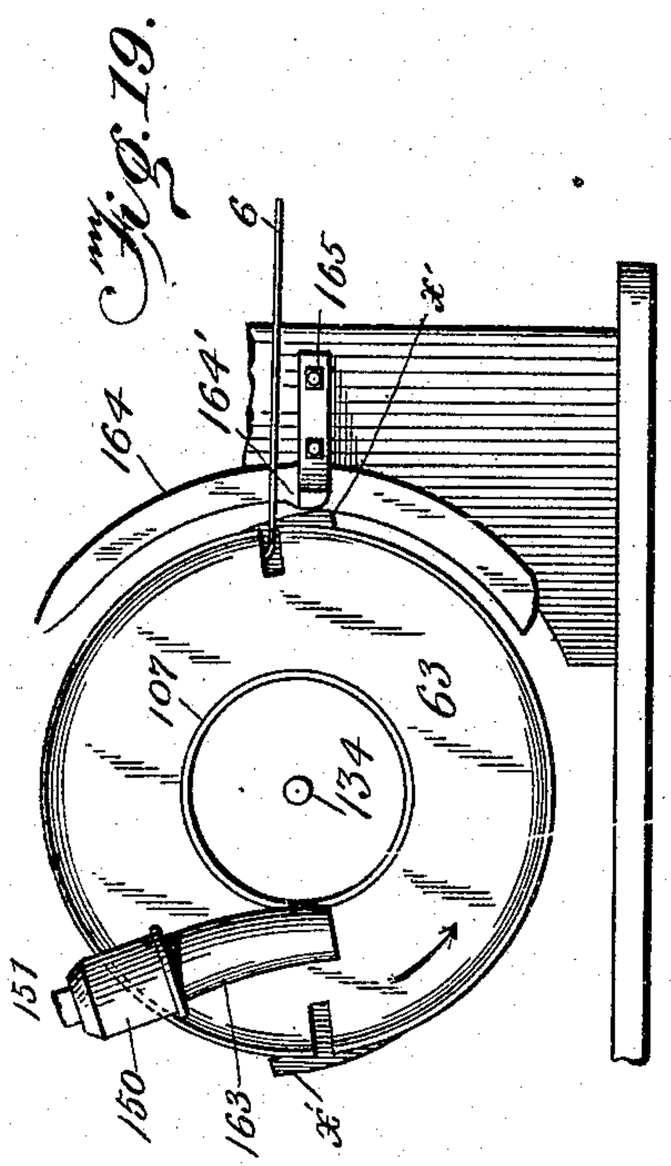

Fig. 18.

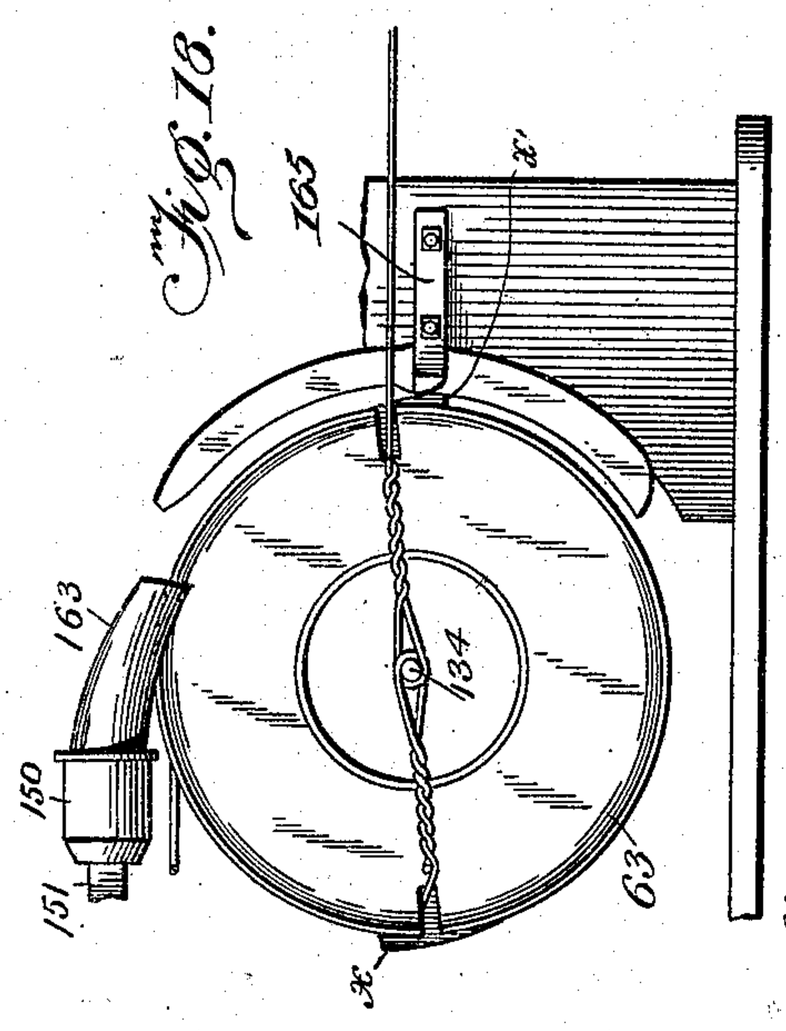

Fig. 22.

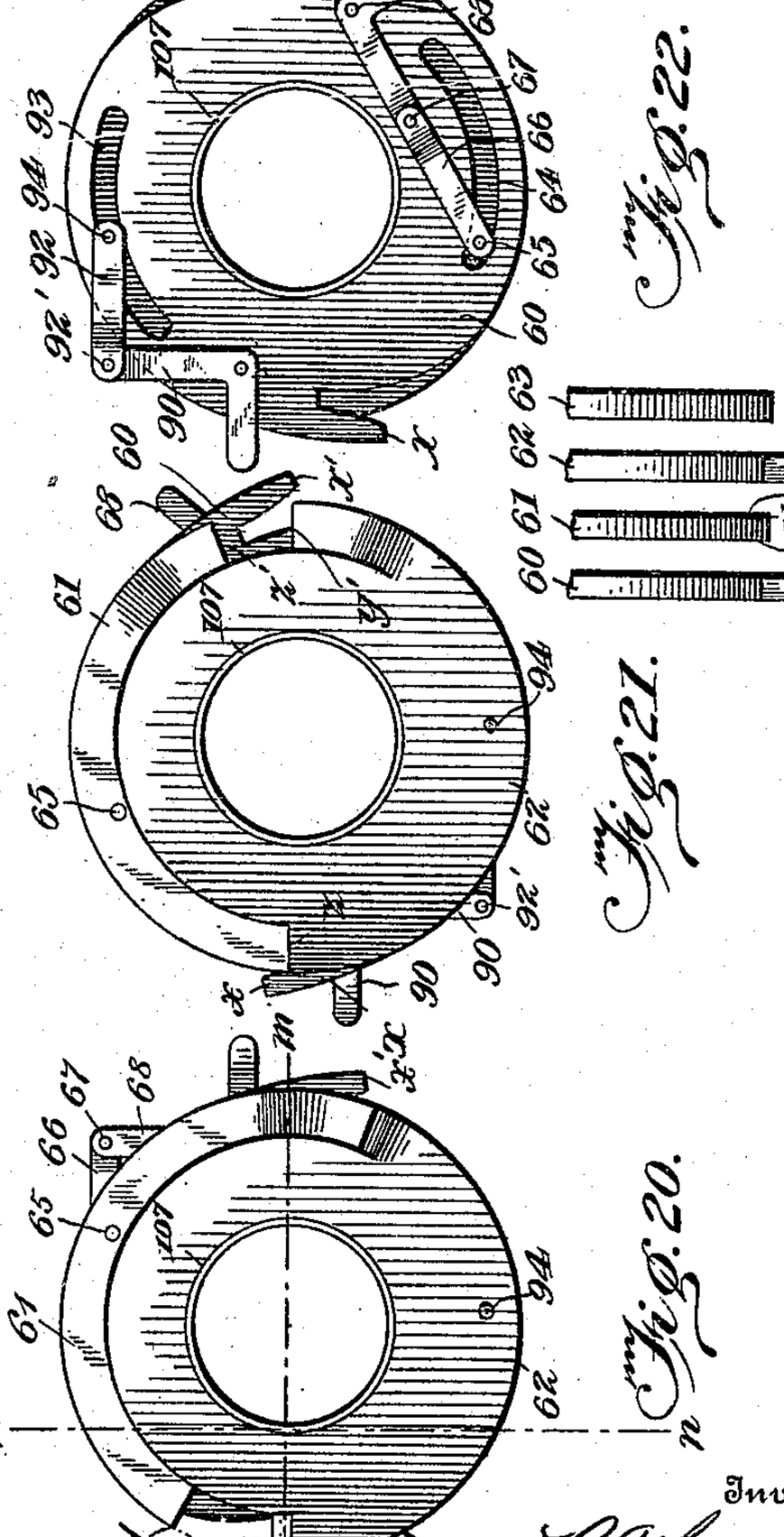

Fig. 23.

Fig. 21.

Fig. 20.

Witnesses

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10 SHEETS—SHEET 10.

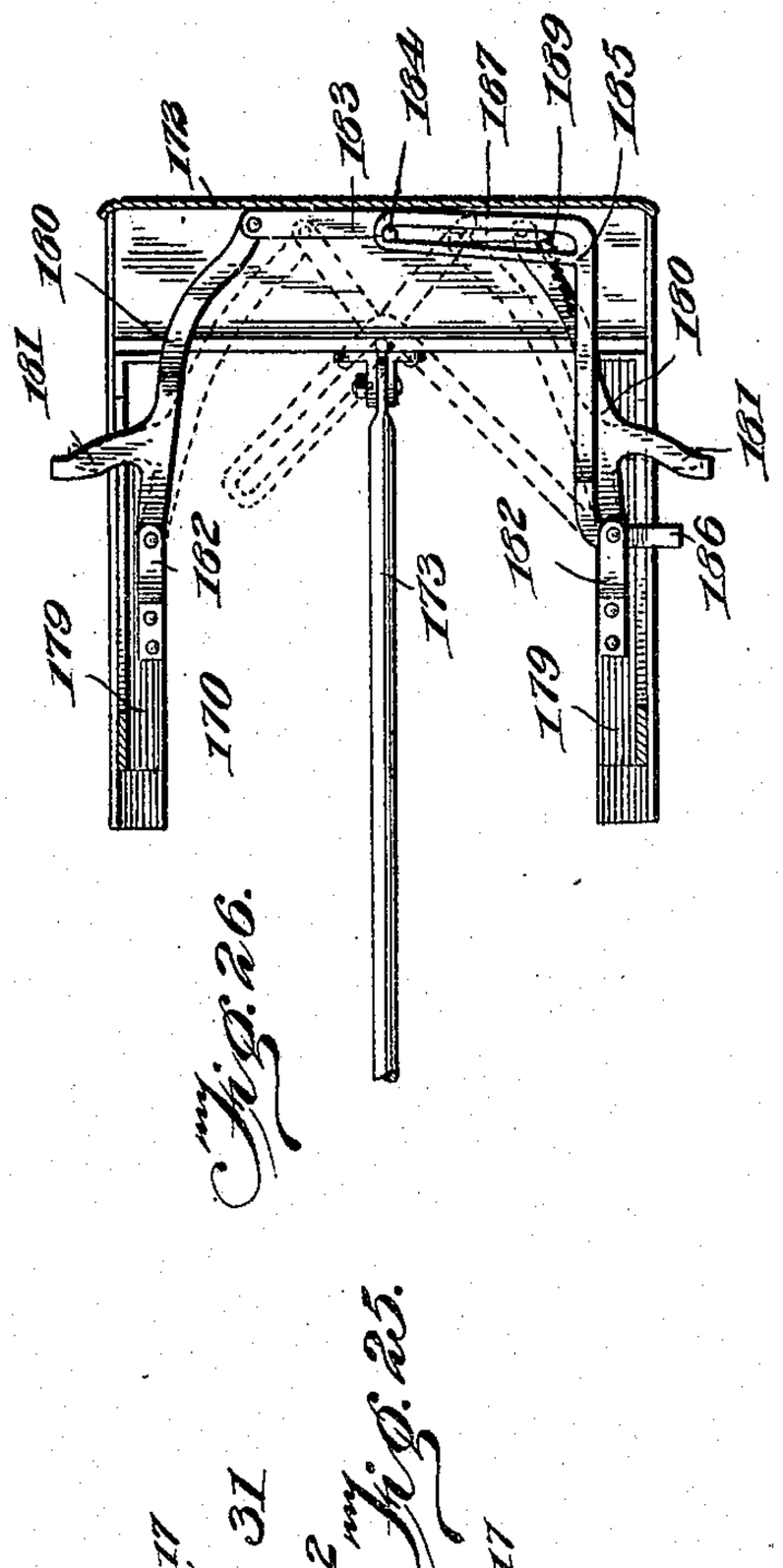

Fig. 26.

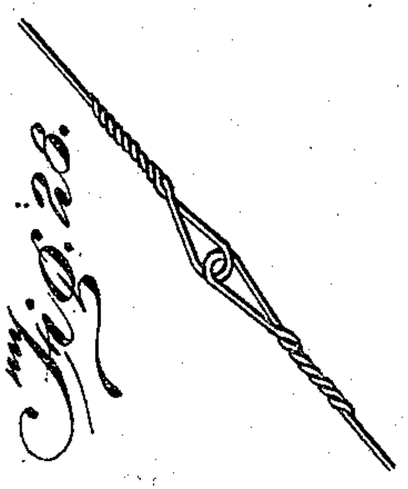

Fig. 28.

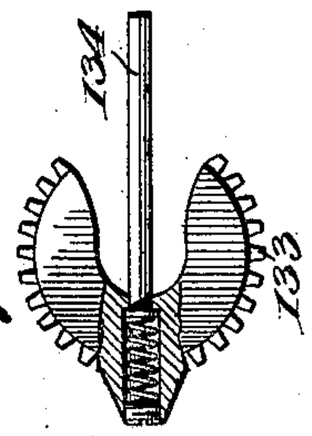

Fig. 29.

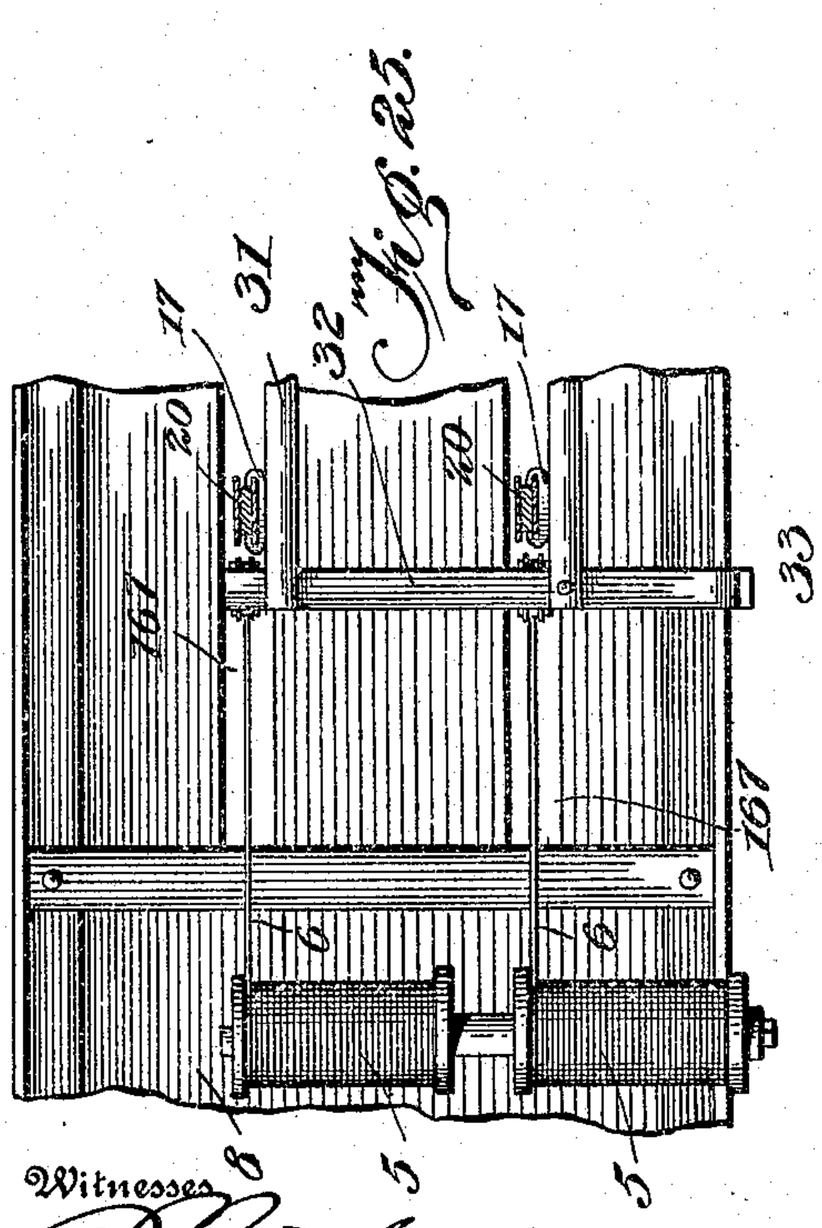

Fig. 25.

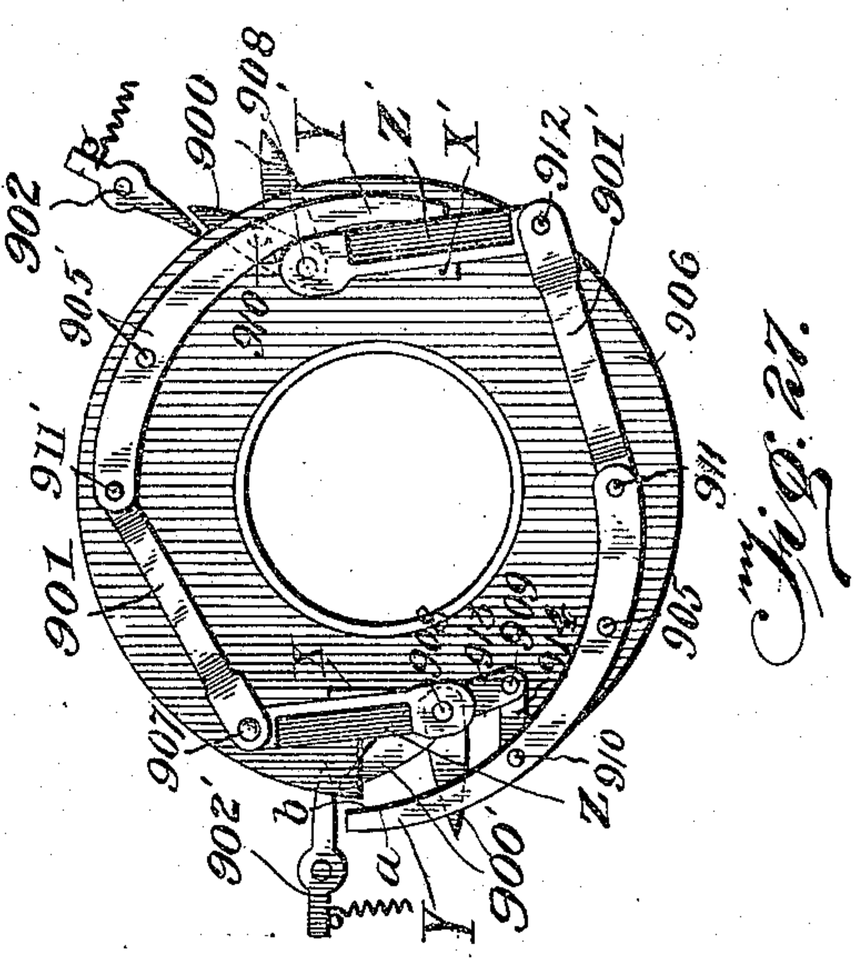

Fig. 27.

Witnesses

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UNITED STATES PATENT OFFICE.

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BALING-MACHINE.

932,755. Specification of Letters Patent. Patented Aug. 31, 1909.

Application filed November 4, 1907. Serial No. 400,612.

To all whom it may concern:

Be it known that we, RICHARD A. CASWELL, CHARLES H. CASWELL, and WALLACE CASWELL, citizens of the United States, residing at Cherokee, county of Cherokee, State of Iowa, have invented certain new and useful Improvements in Baling-Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to presses for baling hay, straw, and the like, in which the compression of the material is effected by means of a reciprocatory plunger and the tying or wiring of the bale is accomplished automatically by apparatus which feeds the wire around the bale, loops the ends thereof together and twists the looped ends, and finally severs the wire adjacent to the looped tie, after which the finished bale is discharged from the compression chamber.

The invention consists of the novel features and details of construction and operation fully described in the following specification and set forth in the claims appended thereto.

In the accompanying drawings: Figure 1 is a plan view of the machine, with certain portions thereof broken away. Fig. 2 is a side elevation thereof; Fig. 3 is a fragmentary plan view of the carriage on the wire tying side of the machine with the tying mechanism removed; Fig. 4 is a side elevation of the mechanism shown in Fig. 3; Fig. 5 is a side elevation of the duplex needle; Fig. 6 is an enlarged fragmentary perspective detail showing the coöperation of the rack bar and the guide therefor; Fig. 7 is an enlarged fragmentary plan view, partly in section, of one of the needles; Fig. 8 is a transverse section of the needle on line 8—8 of Fig. 7; Fig. 9 is a transverse cross-sectional view of the machine in the rear of the plunger; Fig. 10 is a side elevation of the tying mechanism; Fig. 11 is a sectional elevation thereon on line *x*—*x* of Fig. 13; Fig. 12 is a similar view on line *y*—*y* of Fig. 13; Fig. 13 is an elevation of the tying mechanism viewed from the opposite side to that shown in Fig. 10; Fig. 14 is a plan view illustrating the coöperation of the looping mechanism and the needle; Figs. 15, 16, 17, 18 and 19 illustrate successive positions of the wire looping mechanism; Figs. 20 and 21 are detail views of the looping mechanism with the front plate removed; Figs. 22 and 23 are reverse views of Figs. 20 and 21, respectively; Fig. 24 is a fragmentary edge view of one of the looping members with the several parts thereof separated to better illustrate the relation of the clamping and cutting jaws; Fig. 25 is a fragmentary side elevation of the middle portion of the baling chamber showing the relation of the wire spools and the needles; Fig. 26 is an enlarged plan view of the plunger; Fig. 27 illustrates a modified form of the looping member with the front plate removed; Fig. 28 illustrates the form of the complete tie; Fig. 29 is an enlarged detail of one of the twister heads.

Referring to the drawings, it will be noted that the machine comprises a baling chamber, which may be either of the continuous or box type, a reciprocatory plunger operating longitudinally of the chamber to compress successive charges of the material, which is fed into the chamber in the form of a bale, a carriage slidably mounted on the frame of the compression chamber and which is adapted to be connected with the plunger and to move therewith during the final compression stroke, wire feeding apparatus mounted on the carriage on one side of the compression chamber, and wire tying apparatus mounted on the carriage on the opposite side of said chamber, the complete reciprocation of the carriage with the plunger during the final stroke of the latter effecting the feeding of the wire through the forward face of the plunger and into engagement with the looping, twisting and cutting devices, which complete the tie and sever the wire, the final retraction of the plunger serving to return the carriage to its initial position where it is disconnected from the plunger, and the apparatus is restored to condition to receive material for the succeeding bale.

The baling chamber, which, in the particular form of the invention illustrated, is of the continuous type, is formed as a rectangular box-like structure having longitudinal angle iron corner pieces 1 along the lower edges, which form the foundation for the chamber and serve as guides or track-ways for the movable carriage which supports the tying mechanism; top longitudinal angles 2, which are connected to the lower angles 1 by uprights 1′ and 1″; and suitable cross-braces 2″ at top and bottom which complete the frame work; an inclosing top plate 2′,

provided with a filling opening 3; side plates 8 and a bottom plate 3′. It will be understood that, should the machine be employed as a box press, a suitable movable abutment would be provided at the discharge end of the compression chamber, but inasmuch as we prefer to use the machine as a continuous press, as illustrated, in which each finished bale is forced out by the next bale in course of formation, there is provided an inclined run-way or chute 200 hinged to the discharge end of the compression chamber as at 201 (see Fig. 2). The inclined run-way, which may be adjusted by means of links 202, hinged at the upper rearward corners of the compression chamber and adjustably connected to the discharge end of the chute or run-way in any suitable manner, serves to deliver the bales onto a pile, table, or vehicle as desired.

The plunger, by means of which the compression of the material is effected, comprises a rectangular frame 170 made to fit within the compression chamber and slide along the bottom thereof, and is adapted to be reciprocated by a suitable connecting rod 173 which, in turn, may be operated either by hand or by power. The compression face 172 of said plunger is provided with transverse recesses 171 adapted to permit the passage of the wire feeding needles, as will be hereinafter more particularly explained. Pivotally mounted in brackets 182 on side members 179 of the plunger 170 are two levers 180, each having a laterally projecting latch finger 181, which finger serves under appropriate conditions, hereinafter explained, to lock the plunger to the movable carriage to cause the latter to move with the plunger, as will also be explained more particularly hereinafter. The said levers 180 are connected at their forward ends by a toggle 183, the central pivot pin 184 of which projects upwardly and is adapted to be engaged by a generally rectangular tripping lever 185, said tripping lever being pivoted on the same axis as one of the levers 180, and having a laterally extending actuating finger 186 near the pivotal point and provided with an elongated slot 187 at its other end in which pin 184 of the toggle 183 is engaged, so that, when said trip lever is thrown in one direction or the other, the toggle is actuated to swing levers 180 to advance fingers 181 into locking engagement with the carriage, or to retract the same and release the carriage from the plunger. The toggle 183 is held in either position by means of a spring 189 connected to one end of said toggle and to one of the levers 180.

The movable carriage 30 comprises bottom members 33 extending below and transversely of the baling chamber, and are secured to the lower angle iron 1 thereof by means of Z-shaped brackets 34 to permit said carriage to be reciprocated longitudinally of the baling chamber. The right-hand side of said carriage is a generally rectangular frame work, 32, 33′ mounted upon and connecting the bottom members 33 into a rigid structure and also supporting a table-like element 31 upon which the needle actuating mechanism is mounted, and the portion of the carriage on the left-hand side of the baling chamber consists of a simple flat skeleton frame formed of the ends of bottom members 33 and longitudinal members 30′, upon which the tying mechanism is adapted to be secured by bolts or other appropriate means.

The wire feeding needles 20, which in the present machine are two in number, are preferably made as an integral structure of U-shape, having lateral grooves 24, 25 on opposite sides thereof, which engage flanged guides 17 secured in horizontal position on the carriage 30, as indicated in Figs. 1 and 9, so as to admit of the reciprocation of the needles transversely of the carriage and the baling chamber. The forward end of each needle is provided with guide rollers 21 and 22 mounted upon pintles 26 and 27, which rollers serve to receive and guide the wire which is taken from two spools 5—5 mounted upon a suitable bracket 4 at one side of the baling chamber in advance of the carriage. The forward end of each needle is cut away at 23 for a purpose to be hereinafter explained. Guide sheaves 17′ are mounted on the carriage adjacent to the needles and serve to direct the wire to the needles and hold the same in proper relation to the needles as the latter advance across the baling chamber.

The mechanism for reciprocating the needles comprises a bell-crank 15 pivoted at 15′ to the table 31 of the carriage 30, and connected to a central bar 20′ of the duplex needle by a link 19. A second bell-crank 12, pivoted at 13′ to the carriage top, is connected to bell-crank 15 at a point intermediate the ends of the longer arm thereof by a link 14, and said bell-crank 12 is in turn connected with the forward end of a knuckle-lever 10 having a rule or knuckle-joint 10″ midway its length and pivotally connected at 9 near the discharge end of the baling chamber and having at its forward end a detent or abutment 10′, which is adapted to be engaged by the long arm of the bell-crank 15 when the latter assumes the position shown in dotted lines in Fig. 1, as the needles reach the end of their forward stroke, thereby causing the knuckle-lever 10 to swing outward at joint 10″ and permit the needles to remain stationary until the short arm of the angle-lever 15 comes in contact with a lug 9′ on the baling chamber. It will be understood, of course, that this operation of the needles is effected when the

carriage has been positively connected with the plunger and moves therewith. The initial movement of the carriage serves to operate the system of levers to advance the needles across the table and through the baling chamber until the forward ends thereof lie adjacent the tying mechanism. When this point is reached, lever 15 engages detent 10′ on the end of the knuckle-lever 10, causing the latter to move outward at the joint 10″ and the operative connection between the needles and the system of levers is interrupted, permitting the needles to remain stationary until the short arm of the bell-crank 15 strikes detent 9′ as the carriage continues to advance, and this engagement between bell-crank 15 and detent 9′, during the continued advance of the carriage, retracts the needles to their original position. As the carriage continues its advance, the end of the short arm of lever 15 slips past lug 9′ and allows the carriage to move to the end of its forward stroke. During the return movement of the needles by the reverse operation of bell-crank 15, all of the needle mechanism is restored to its original position, as shown in full lines in Fig. 1, except knuckle lever 10 which continues to break outward at the joint 10″ during the further advance movement of the carriage. After the carriage has reached the end of its forward stroke and starts on its return movement with the plunger, the knuckle lever 10 is gradually straightened, and when the carriage reaches the end of its return stroke said lever has moved until its two arms are in alinement, at which time spring 13, attached to one end thereof and the table throws the joint 10′ beyond the dead center and until the lever is arrested by an adjustable stop 12′, thereby restoring all of the needle actuating mechanism to a proper relation for the next stroke.

As indicated, the carriage remains stationary with respect to the baling chamber until it is operatively connected with the plunger, and such connection is not made until the final compression stroke of the plunger has been begun. The plunger is connected with the table by means of fingers 181 carried by the levers 180, hereinbefore explained, said fingers 181 being moved outward by the mechanism provided for this purpose into engagement with suitable orifices in the sides of the movable carriage adjacent to the sides of the baling chamber, the latter being slotted at 167 to permit the passage of locking fingers 181, and also to allow the wire feeding needles to pass into operative relation with the tying mechanism.

The tying mechanism, as hereinbefore explained, is mounted upon the movable carriage and is operated by the advance of the carriage to effect the complete tying operation during the advance movement of the carriage and is rendered inoperative during the return stroke of the carriage. The means for effecting the proper operation of the tying mechanism consists of a bar 40 connected by bell-cranks 47 and 48, pivotally connected to the left-hand angle iron at the bottom of the baling chamber, as more particularly illustrated in Figs. 3 and 4. Each of said bell-cranks 47 and 48 is pivotally connected to said bar 40, and to an actuating bar 44, which latter is adapted to be moved longitudinally of the baling chamber sufficiently to move the rack 40 toward and from the baling chamber. When the bar 40 has been moved out from the baling chamber, as indicated in full lines in Fig. 3, three racks 41, 42 and 43 carried thereby, are in position to engage the actuating gears on the tying mechanism, and when said bar 40 is moved toward the baling chamber the racks thereon are out of the line of travel of the gears which drive the tying mechanism. After the carriage 30 has been connected to the plunger 107, and has been moved with the plunger to the point of the beginning of the forward stroke, shown in full lines in Fig. 3, a detent 49 on the carriage engages an angular portion 44′ of the bar 44, and moves the latter rearwardly, thereby causing bell-cranks 47 and 48 to swing rack bar 40 away from the baling chamber and into position to cause the racks 41, 42 and 43 to lie in the path of movement of the actuating gears of the tying mechanism. As the carriage and the plunger approach the end of their forward stroke, a detent 45′ on the carriage 30 engages roller 45 mounted on connecting rod 44, and causes the latter to move with the carriage, which has the effect of causing bell-cranks 47 and 48 to swing rack bar 40 toward the baling chamber to the position indicated in dotted lines in Fig. 3, and out of the path of the movement of the gears of the tying mechanism. It will be observed that, although two different devices are employed for effecting the movements of the connecting rod 44 in the respective directions, either device might be duplicated, and obviously any other appropriate means for effecting the movement of said connecting rod 44 might be employed. The rack bar 40 is provided with U-shaped guides 46 attached near the respective ends of said bar, which guides embrace the lower flange of the angle 1 on the lower left-hand edge of the baling chamber and serve to retain the rack bar rigidly in position, but permit the bar to move freely toward and from the baling chamber. In order that the rack bar may be held securely in alinement to mesh with the gears of the tying mechanism during the forward stroke of the carriage, there is provided on the carriage a bracket 37 with a slot 36 in the end thereof, which is adapted to be engaged by a rib 35 on the underside

of said rack bar, as indicated in detail in Fig. 6, said rib 35 being of such length that one end thereof passes beyond the slotted end 36 of bracket 37 when the carriage reaches the end of its forward stroke to permit the rack bar to be swung toward the baling chamber and the other end of said rib to pass into alinement with said slot when the carriage has been returned to the limit of its rearward movement.

The mechanism for effecting the tying operation is duplicated in the machine illustrated, and therefore it will be necessary to explain but one of the devices. The tying mechanism is mounted upon a base 100, which is adapted to be bolted to the portion of the carriage 30 which extends outwardly on the left-hand side of the baling chamber, and on said base there are provided posts or brackets 101, 102, 103, 104 and 105 which support the various parts of the tying mechanism. Each of the wire tying mechanisms comprises a rotary clamping head which is adapted to loop the ends of the wire to be secured together about a central pin, and a rotary twisting head which includes said pin together with appropriate clamping devices for holding the looped wire on opposite sides of said pin. Each of said wire looping members consists of an annular plate 60 provided with two projecting lips or hooks x, x' disposed at diametrically opposite points of the circumference of said plate, and having on its rearward periphery suitable gear teeth 72 by means of which said plate may be rotated upon a central hollow journal or sleeve 107 fixed to standard 102. Adjacent to the hook members x, x', the plate 60 is provided with clamping faces a, a, as shown in Fig. 24. Coöperating with said disk 60 are two annular disks or plates 61 and 62, which are formed precisely alike but are reversely arranged with respect to each other. Said two plates 61 and 62 are likewise mounted on the sleeve-like trunnion and are retained in generally concentric arrangement with plate 60 by means of a front retaining plate 63 also mounted on trunnion 107. Each of said members 61 and 62 is cut away circumferentially for substantially 180 degrees, thereby providing on each two shoulders, which are adapted to be brought alternately in engagement, as indicated in Figs. 20 and 21, to wit, a shoulder y on member 61, which is provided with a lateral clamping face b, coöperates with the clamping face a adjacent the hook x on member 60, and a shearing edge c adapted to coöperate with the edge d of the shoulder z on 62. Similar clamping and shearing elements are disposed on the plates at diametrically opposite points and are so related that, when the wire is sheared between jaws y', z', it is released by the jaws x, y, and when the wire is sheared between jaws y, z, it is released by jaws x', y', that is to say, when the jaw y closes upon the jaw x, the shear y', z' opens, and similarly when jaw y' closes on x', shear x, y opens. It will be noted that, in order to effect an absolute homologous arrangement of the clamping and shearing elements of plates 61 and 62, the jaws y' and z' on 62 and 61, respectively, are offset, as indicated in Figs. 20 and 21, so that the jaw opposite y on plate 61 is z', and the jaw opposite z on plate 62 is y', and the two plates are so connected that, when the jaws y and z are fully separated, the opposite jaws y' and z' are completely closed upon each other. The means for effecting the relative movement of plates 60, 61 and 62 consists of duplicate sets of lever mechanism for connecting plate 60 with plates 61 and 62, respectively, and more particularly illustrated in Figs. 10, 22 and 23. Mounted on the rear face of the plate 60 is a bell-crank 68, one end of which normally projects beyond the edge of plate 60, and the other end of which is pivotally connected at 67 with a link 66 which, in turn, is connected at its opposite end by a pin 65 which passes through a slot 64 in plate 60, and is connected to plate 61 so that, as said bell crank lever is moved in one direction or the other, plate 61 will be moved correspondingly with respect to plate 60 and plate 62. A precisely similar arrangement of actuating means for disk 62 is located diametrically opposite that just described, and consists of a bell-crank 90 pivoted at 92′ to a link 92, which has at its free end a pin 94 passing through a slot 93 in plate 60 and attached to disk 62, so that the latter is moved with respect to plates 60 and 61, in accordance with the movement of bell-crank 90. The face plate 63 is notched at diametrically opposite points in order to hold the ends of the wires and in a measure relieve the clamping jaws from the strain imposed thereon during the looping and twisting operations.

Mounted on the standard 102 are two dogs 69 pivoted upon studs 69′, the forward ends of which lie in the path of movement of the projecting ends of bell-cranks 68 and 90, as the looping heads are revolved, and serve to move the bell-cranks in a clockwise direction, as viewed in Fig. 10. Each of said dogs 69 engages a stop 70, and is normally held against the same by a spring 71 attached to its free end and anchored to the standard 102. It will be noted that this arrangement of the dogs will permit the bell-cranks 68 and 90 to pass freely without moving, as the looping heads move in a reverse direction. To effect the opposite movement of bell-cranks 68 and 90 on the looping heads, there are mounted on standard 101 two spring held dogs 86, which are reversely arranged with respect to dog 69 and serve to move bell-cranks 68 and 90 in

the opposite direction to which they were moved by the dog 69, as will be apparent from an inspection of Figs. 10 and 13. Each of the plates 60 of the twister heads is provided with a gear rim 72 on its rear face, and between said gears there is disposed an idle pinion 73. The gear rim 72 on the lower twister head is engaged by a pinion 74 mounted upon a shaft 74′ supported in standard 102, which gear 74 meshes with a gear 78 mounted upon the shaft 78′, on the outer end of which is a pinion 85 adapted to be brought into mesh with racks 42 and 43, respectively, on bar 40. In order to hold the twister heads in proper relation, gear 78 is provided with a notched rim 79 with which coöperates a bowl or traveler 76 mounted upon a pivoted arm 74 and normally held in engagement with the rim 79 by a suitable spring 80. The engagement of the bowl or traveler 76 with one of the recesses in the rim 79 is sufficient to prevent the gear train being accidentally displaced but does not interfere with the proper operation of the mechanism, and during the rotation of gear 78 the bowl travels upon the circular portion of the rim but immediately drops into the appropriate recess and locks the gearing when the movement of the looper heads has been completed.

The mechanism for twisting the wire behind the engaging loops comprises a twisting head associated with suitable clamping jaws, which head and jaws are located centrally within the looping head, and said twisting head is mounted for rotation upon an axis at right angles to the axis of rotation of the looping head, means being provided for operating the twisting head and also for advancing the same to operative position to engage the wire at appropriate times. The twisting heads in both of the tying mechanisms are identical, and it will be necessary to describe only one of said heads. A generally U-shaped frame 111 is mounted for reciprocatory motion upon guides 106 on the standard 102, as indicated in Fig. 10. The horizontal arms of frame 111 project into the sleeves or trunnions 107 of the looper heads. Journaled in the forward ends of the horizontal members of frame 111 are twister heads 133, one for each tying mechanism, each head comprising a rotatory member having a transverse groove or recess passing therethrough and provided with a spring pressed pin 134 supported in the body of said member and projecting through the recess and beyond the periphery in a direction transverse to the axis of rotation of said member, as more particularly indicated in Fig. 29. One peripheral edge of said twister head is provided with gear teeth with which coöperate two pinions 132 mounted in frame 111, each of said pinions being engaged by an idler 131, the purpose of duplicating pinions 132 being to insure a driving connection for twister heads 133 at all times, even when one of the said pinions 132 lies opposite the cut-away or segmentally grooved portion of said twister head. The upper idler 131 is driven by a gear 130′ mounted upon a shaft 130″ in frame 111, which in turn meshes with idler 135 mounted upon shaft 135′, which latter is in engagement with a gear 130 mounted on shaft 139, said gear 130 also meshing with the lower pinion 131. Gear 130 is provided with a rim 136′ having therein a depression 136″ adapted to receive a bowl or traveler 136 mounted upon a lever 137 and subject to spring 138 which serves to lock the gearing in proper position, as will be well understood. Shaft 139 is provided with two universal joints 139′ and 139″ with an intermediate coupling shaft 139‴, and the outboard end is journaled in bracket 105 secured to the base plate 100. Instead of the universal joints shown in shaft 139, the latter may be formed as a flexible shaft of any suitable type, and the purpose of making said shaft flexible is to provide a satisfactory driving connection for gear 130 which operates the twister heads and permits the frame 111 to be reciprocated. Mounted on the end of shaft 139 is a beveled pinion 82 which meshes with a beveled gear 81, mounted upon a shaft 83 journaled in bracket 104′ mounted on the base 100. On the outer end of shaft 83 is a small spur gear 84 which meshes with rack 41 under appropriate conditions and imparts motion through the train of gearing to the twister heads 133.

It will be understood that the twister heads 133 will be brought into operation after the wires have been looped about central pins 134, as shown in Fig. 17, and to effect this the sliding frame 111 is advanced so as to bring the looped wires well within the recessed portions of the respective twister heads 133 and at the same time to actuate the clamping jaws by means of which the wire is held on each side of the loop while the twister head is being operated. These clamping jaws, which are clearly illustrated in Fig. 12, are duplicated in the twisting mechanisms, and each consists of a pair of fingers 140 pivotally mounted in the sleeve or trunnion 107 upon pintles 143, and each of said fingers is connected by knuckle-joints or levers 141 with frame 111, the ends of the knuckle-joints being connected to the fingers and to the frame by suitable pintles 142 and 144, respectively, so that, as said frame is advanced, the fingers 140 of each set of the clamping jaws are brought together and clasped around the looped wires to hold the latter while they are being twisted.

The closing of the jaws 140 is effected, as

indicated, by the movement of frame 111 toward the looper head, and this movement of said frame 111 is effected by the following mechanism:

Pivotally mounted at its center 110′ upon the base plate 100 is a horizontal lever 110, having on one end thereof a roller 112 which is adapted to engage the end of the rack 42 on rack bar 40, and at its opposite end a roller 112′ which is adapted to engage an inclined lug 56 projecting laterally from the frame or support of rack 43 on rack bar 40, indicated in Fig. 3. Connected to said lever 110 at one side of the center is a link 113, which is operatively connected with a bell-crank 114 pivotally mounted on the frame at 115 which is connected at its other end by a link 117 to a pivoted lever 120 journaled intermediate its ends upon pivot 120′ mounted on standard 106′ formed as part of the base 100; the opposite end of said lever 120 being connected by link 121 with frame 111 by means of a pivot pin 123, as indicated in Fig. 12. By means of this system of link and lever mechanism, it will be noted that, when lever 110 is swung in one direction by the engagement of roller 112 with rack 42, frame 111 will be moved inward toward the baling chamber, and conversely, when lever 110 is moved in the opposite direction by the engagement of roller 112′ with lug 56 on the under side of rack 43, the said frame is retracted or moved away from the baling chamber and the clamping jaws 140, which were closed by the forward movement of frame 111, are restored to open position, as indicated in Fig. 12. A spring 122′, connected to frame 111 and to standard 106′, tends to hold the frame 111 in retracted position and assists in restoring said frame to such position after it has been advanced. In order to lock frame 111 at the end of its forward movement, there is provided on the latter a stop or lug 124 against which link 121 strikes after said links 120 and 121 have passed the dead center, as shown in dotted lines in Fig. 12.

Pivotally mounted adjacent each of the tying mechanisms on standard 104, as indicated in Figs. 2, 10 and 13, are wire rollers or guides 150, each of which is revolubly mounted upon fingers 151 which are pivoted to standard 104 upon pintles 152, respectively. A spring 153, connecting levers 151, with the standard 104, tends to hold the levers and guide rollers in horizontal position, indicated in dotted lines in Fig. 13. The forward end of each of said levers 151 is enlarged and curved downwardly to form a guide finger 163 for the wire. Connected to the lower end of the roller lever 151 is a bell-crank 159, which is pivoted at 160 to standard 104, the free ends of said lever 159 extending downwardly and adapted to engage a stationary lug or bracket 166 on bottom flange 1 of the baling chamber, as illustrated in Fig. 2, and also to engage the end of rack 41 and move the guide rollers into horizontal position. The upper lever 151 is connected to the standard 104 by a toggle comprising members 154, 156, to the central pin 155 of which is pivoted a link 158 connected at its opposite ends to a pin 161 mounted in bell-crank 159. A stop or detent 156′, projecting from standard 104, serves to limit the movement of the toggle 154, 156, past the dead center and therefore to lock the two levers 151, and their associated roller guides 150.

Mounted adjacent each of the tying mechanisms is a curved wire guide 164, clearly shown in Fig. 13, each of which is supported by a bracket 165 secured to standard 108, each of said brackets having also a laterally projecting finger 164′ which serves as a horizontal guide for the wire, as more particularly illustrated in Figs. 15 to 19, inclusive. The lower bracket 165 also serves as a guide for rack 43 on rack bar 40, while the latter is in mesh with spur gear 85. Pivoted to the sides of the baling chamber adjacent to the slots 167 therein, are dogs 168 which normally lie across the respective slots, but which are adapted to be moved upward by the wires as the latter are advanced by the forward movement of the carriage, said dogs subsequently dropping to their lower position where they are retained by suitable stops or detents, as indicated, and to hold the wires back of them as they are stretched between the needles and the tying mechanism.

The operation of the apparatus, as hereinbefore described, is substantially as follows: Preparatory to receiving the first charge of hay or the like, the various parts of the machine occupy the relative positions shown in full lines in Figs. 1 and 2. The baling wires 6 pass from the spools 5 through the guide rollers 21 and 22 in the ends of the needles across the baling chamber, behind the dogs 168, to the rearward wire clamping jaws on the rotary wire looping members, the position of each of said looping members being illustrated in Fig. 19. The hay or other material is placed in the chamber through the opening 3 in the top thereof, and the plunger 170 is advanced forcing the material against the wires which are forced toward the rear or discharge end of the chamber, the wires, of course, being paid out from the spools accordingly. After a sufficient number of charges have been placed in the chamber and successively compressed to make a bale of the required size, and when the plunger 170 reaches the position on its final compression stroke where needles 20 come opposite the grooves 171 in the face 172 of plunger 170, trip lever 185 is actuated by means of finger 186, which may be en-

gaged by the hand of the operator, to straighten toggle 183 and thereby project fingers 181 on levers 180 laterally from the sides of the plunger and into engagement with suitable locking orifices in the sides of the carriage 30 adjacent to the sides of the baling chamber, which has the effect of locking the carriage to the plunger and to cause the two elements to advance together during the final compression stroke of the plunger.

As hereinbefore explained the toggle is adapted to be actuated to swing levers 180 into and out of locking engagement with the carriage and said toggle is held in either of its extreme positions by spring 189. The trip lever 185 is connected to the central pivot pin 184 of the toggle, so that when said trip lever is moved in one direction or the other by the hand of the operator, the toggle will either straighten out to move the fingers 181 into position to engage the locking orifices in the sides of the carriage when said fingers come opposite said orifices, or on the other hand, said toggle will fold inwardly to retract fingers 181 and disengage the plunger from the carriage. The first effect of the conjoint movement of the plunger and carriage is to cause the needles 20 to be advanced across the baling chamber which carries the two strands of the wire around the rear face of the bale and lays the same opposite the hooks x on plates 60 of the wire looping heads, as indicated in Fig. 14. The particular operation of advancing and returning the needles has been fully set forth hereinbefore and need not be repeated, except to state broadly that it is effected by the link and lever mechanism, particularly illustrated in Figs. 1 and 9.

In the normal position of the apparatus, shown in Figs. 1 and 2, rack bar 40 occupies the position shown in Fig. 3, with the racks 41, 42 and 43 in position to be engaged by the spur gears on the tying mechanism. As soon as the needles complete their inner stroke so that their ends lie adjacent the looping mechanism, as indicated in Fig. 14, spur gear 85 passes into mesh with rack 42 which turns each of the looping heads through the trains which actuate the gear rims, 72—72, on the rear of plates 60 of the respective looper heads. Each looper head makes one complete revolution. The initial movement of each looper head causes the corresponding finger x on plate 60 to pass through the cut-away portion 23 of the corresponding needle behind the wire, and the further movement of the looper head causes bell-crank 68 to engage dog 69, which straightens out the knuckle-joint formed by link 66 on one end of bell-crank 68, and rotates disk 61 a short distance and in opposite direction to the movement of the looper head as a whole. This causes the clamping jaw y on plate 61 to close on x, causing the clamping faces a and b on the respective plates to grip the wire and hold the same firmly in position. It will be understood, of course, that the free end of the wire is held during this operation between the corresponding clamping faces and jaws x', y', on the diametrically opposite side of the looper head, as indicated in Figs. 15 to 19, inclusive. As each looping head continues its revolution, the respective ends of the wire assume the several positions shown in Figs. 15, 16 and 17, and until the jaws x, y, on the looper head return to their initial position, as indicated in Fig. 17, when the wire has been looped twice about central pin 134 on the twister head 133 and the two loops are locked together, the guide roller 150 serving to properly direct the wire from the corresponding needle to the periphery of the twister head, and the finger 163 in advance of said roller serving to lay said wires in proper relation to cause the loops to interlock. When the twister heads have made one complete revolution, gear 85 passes out of engagement with rack 42, and at this point in the operation of the machine roller 112 on lever 110 strikes against the end of rack 42 and advances frame 111, carrying the twister heads toward the baling chamber and at the same time closing fingers 140 of the clamping jaws over the loops of the wires which lie in the recessed portions or segmental grooves in the twister heads 133. The continued forward motion of the carriage 30 brings gear 84 into mesh with rack 41, which actuates the twister heads through the system of gearing, hereinbefore described, turning the twister heads 133 through the desired number of revolutions, in the present instance three, which effectively twist the loops of the wires on themselves, as shown in Fig. 18. Roller 112′ then engages lug 56 below rack 43, which returns the frame 111, with the twisting apparatus to its initial position and releases the wires from the clamping jaws 140, so that the knot or tie will slip off the end of the pin or finger 134. At this time the spur gear 85 passes into mesh with rack 43, which reverses the motion of the wire looping heads through one-half revolution, as shown in Fig. 19. As soon as the looping head starts to revolve backward, bell-crank 90 engages dog 86. This breaks the knuckle joint formed by bell-crank 90 and link 92, and opens the jaw y' and at the same time moves the wire cutting edge d of shoulder z on plate 62 into contact with the wire cutting edge c on shoulder y of plate 61, which severs the wire between the clamping jaws x, y and the knot, the needle end of the wire being still retained in the jaws x, y, so that, when the looper head has been revolved backward a complete half revolution, the hook x' on plate 60 assumes the position

previously occupied by hook x. The needle end of the wire still being held by the clamping jaws x, y, and the carriage advancing to the forward end of its stroke, said needle end of the wire drops behind dogs 168 in position to surround the forward end of the next charge. When the carriage is returned to its starting point, the loose needle wire, which was wrapped around the outside of the looping member, is drawn into the position shown in Fig. 19, and the jaws x', y' stand open to receive the wire from the needle for the next bale.

After severing the wire behind the knot the carriage advances to the extreme end of its forward travel, and detent 45′ strikes roller 45 on bar 44 which moves the latter in the same direction that the carriage is moving, and by means of bell-cranks 47 and 48 shifts the rack bar 40 toward the baling chamber and into the dotted position shown in Fig. 3. On the return stroke, while the carriage and plunger are still connected, it will be observed that the rack 40 is out of alinement with the gears on the tying mechanism and that therefore the latter will not be operated. As the plunger and carriage approach the end of their rearward stroke, and the carriage reaches the position indicated in Fig. 1, the plunger is disconnected from the carriage either manually or by the automatic means shown in Fig. 25, but before the carriage comes to rest detent 49 thereon engages bar 44, moving the latter rearwardly and shifting rack bar 40 through connected bell cranks 47 and 48 outward from the baling chamber into the position shown in full lines in Fig. 3, and in proper alinement to mesh with the spur gears 84 and 85, which drive the looping and twisting mechanism, respectively. At the same time bell crank 159, engaging detent 166, raises guide levers 151 to the position shown in dotted lines in Fig. 13. The apparatus is thus ready to receive the material for a new bale and the operation described is repeated. Each bale, as it is completed, is forced onto the runway 200 which, of course, contains a number of bales, and the end bale on said runway is discharged upon a suitable receiver, as hereinbefore described.

The modified form of head, shown in Fig. 27, is essentially the same in principle and operation as that shown in Figs. 20 to 24, inclusive. The head consists of two similar plates, the front one of which is removed in Fig. 27, the main or rear plate 906 alone being shown. Between the plates of the head are mounted two sets of wire clamping and wire shearing devices, which are precisely alike and located diametrically opposite each other on the head, and therefore the description of one set of clamping and shearing devices will suffice for both. The hook member Y is pivotally mounted on plate 906, at 905 and has a wire clamping face a which closes down on the outer face of the stationary jaw X located on the back of the cutting member Z. The member Y also has a shearing edge b against which the cutting member Z acts. The member Z is pivotally mounted on plate 906, at 908. Members Y and Z′ are connected at 911 and 912 by link 901′, and members Y′ and Z are connected at 911′ and 907 by link 901. The fingers 900 and 900′ are pivotally mounted on the outside of the plate 906, and rigidly attached to shaft 908, and lever 913 is also rigidly attached to said shaft and is connected with the member Y by link 914.

The operation of the modified form of the head is substantially as follows: When the head is revolved in a clockwise direction, the finger 900 engages the dog 902′, which causes shaft 908 to rotate and thereby to operate links 913, 914 to move the member Y inward until the face a thereof engages the outer face of X to clamp the wire between the said faces. The opposite end of member Y moves outwardly or in the opposite direction, which opens the shear Z′. When the head is revolved in the opposite direction, the finger 900′ strikes the dog 902 which, acting through shaft 908 and links 913 and 914, moves the hook member Y in the opposite direction and causes clamping face a to pass out of engagement with clamping face X. At the same time shear member Z′ is forced outward and catching the wire between its edge and the shearing edge b on Y′ severs the wire.

The operation described applies to each set of shearing and clamping devices and, when the jaw Y opens, the shear Z′ closes, and, when the jaw Y closes, the shear Z′ opens, and similarly, when jaw Y′ opens, the shear Z closes, and when jaw Y′ closes, shear Z opens, the respective jaws being closed when the head is revolved in a clockwise direction and open when the revolution of the head is reversed.

What we claim is:

1. A baling press, comprising a plunger a reciprocatory carriage, wire tying mechanism and wire feeding mechanism mounted on said carriage on opposite sides of the baling chamber, means to reciprocate said carriage, and means to actuate the feeding and the tying mechanisms.

2. A baling press, comprising a reciprocatory carriage, wire tying mechanism and wire feeding mechanism mounted on said carriage on opposite sides of the baling chamber, a compression plunger adapted to be connected with the carriage to reciprocate the same, and means rendered operative by the reciprocation of the carriage to actuate the feeding and tying mechanisms.

3. A baling press, comprising a reciprocatory carriage, wire feeding needles slidably

mounted on said carriage, a compression plunger having transverse slots in its face, means to intermittently connect the carriage with the plunger, and means rendered operative by the movement of the carriage to reciprocate the needles through the slots in the face of the plunger.

4. A baling press, comprising a reciprocatory carriage, wire tying and feeding mechanisms mounted on said carriage, means rendered operative by the movement of the carriage to actuate the feeding and tying mechanisms, and means to engage and disengage the plunger and carriage.

5. A baling press, comprising a compression chamber, a reciprocatory plunger therein, a reciprocatory carriage on the compression chamber, wire feeding and tying mechanisms on said carriage, means for connecting and disconnecting the plunger and carriage, and means rendered operative by the conjoint motion of the plunger and carriage to operate the feeding and tying mechanisms.

6. A baling press, comprising a compression chamber, a reciprocatory plunger therein, a reciprocatory carriage on the compression chamber, wire feeding and tying mechanisms on said carriage, means for connecting the plunger and carriage during the final compression stroke of the plunger, and means rendered operative by the conjoint motion of the plunger and carriage to operate the feeding and tying mechanisms.

7. A baling press, comprising a compression chamber, a reciprocatory plunger therein, a reciprocatory carriage on the compression chamber, wire feeding means mounted thereon at one side of said chamber, wire tying means also mounted on said carriage at the opposite side of said chamber, means for connecting the carriage and plunger during the final reciprocation of said plunger, and means rendered operative by the conjoint motion of the plunger and carriage to operate the feeding and tying mechanisms.

8. A baling press, comprising a compression chamber, a reciprocatory plunger therein, a reciprocatory carriage on the compression chamber, needles mounted on the carriage at one side of the chamber, wire tying means on the carriage at the opposite side of the chamber, means for connecting the carriage and plunger during the final reciprocation of said plunger, and means rendered operative by the conjoint motion of the plunger and carriage to operate the needles and tying mechanism.

9. A baling press, comprising a compression chamber, a reciprocatory plunger arranged therein, a carriage mounted for reciprocatory motion on the baling chamber, means for connecting the carriage to the plunger to cause the two to move together during the final reciprocation of the plunger, wire feeding needles on said carriage, means actuated by the advance of the carriage for reciprocating said needles across the baling chamber, wire tying mechanism on said carriage at the opposite side of the baling chamber, and means for operating the tying mechanism during the forward movement of the plunger and carriage, said operating means being disconnected from the tying mechanism during the return movement of the plunger and carriage.

10. A baling press, comprising a compression chamber, a reciprocatory plunger arranged therein, a carriage mounted for reciprocatory motion on the baling chamber, means for connecting the carriage to the plunger to cause the two to move together during the final reciprocation of the plunger, wire feeding needles on said carriage, link and lever mechanism on said carriage connected at its opposite ends to the baling chamber and to the needles, respectively, for reciprocating the needles during the advance movement of the carriage and plunger, wire tying mechanism on the carriage at the opposite side of the chamber, a rack bar mounted on the chamber for operating said tying mechanism, and means for advancing the rack bar into operative relation with the tying mechanism on the forward stroke of the carriage and for retracting said rack bar from operative relation on the return stroke of the carriage.

11. A baling press, comprising a compression chamber, a reciprocatory plunger therein, a reciprocatory carriage on said chamber, wire tying mechanism on said carriage, a laterally reciprocating rack coöperating with the tying mechanism upon the advance of the carriage, means to throw the rack in engagement with the tying mechanism during the advance of the carriage, and means to retract said rack from engagement with the tying mechanism during the return stroke of the carriage.

12. A baling press, comprising a plunger, a reciprocatory carriage extending on opposite sides of the baling chamber, wire feeding mechanism slidably mounted on said carriage at one side of the baling chamber, wire tying mechanism mounted on said carriage at the other side of the baling chamber, and means operable during the reciprocation of the carriage for actuating the feeding and tying mechanisms.

13. A wire tying mechanism, comprising a rotatory wire looping member and two sets of wire cutting shears oppositely located on said looping member.

14. A wire tying mechanism, comprising a rotatory wire looping member having two wire clamping devices and two sets of wire cutting shears oppositely located on said looping member.

15. A wire tying mechanism, comprising

a rotatory looping head having two sets of clamping and shearing jaws located on opposite sides thereof, and means for operating the clamping and shearing jaws alternately.

16. A wire tying mechanism, comprising a rotatory looping head having a base plate and two relatively movable plates, each of said movable plates having a wire clamping jaw, one edge of which acts as a shear, and a wire cutting jaw diametrically opposite said clamping jaws, the clamping and cutting jaws of the respective disks being arranged adjacent each other.

17. A wire tying mechanism, comprising a rotatory looping head having a base plate provided at its periphery with wire clamping jaws diametrically located, two relatively movable plates adjacent said base plate, each having a wire clamping face cooperating with the respective jaws on the base plate and two cutting edges, diametrically opposite.

18. A wire tying mechanism, comprising a rotatory looping head having a base plate and two relatively movable plates, each of said movable plates having a wire clamping jaw, one edge of which acts as a shear, means for rotating the looping member, and means for operating the relatively movable plates to actuate the wire clamping and cutting members.

19. A wire tying mechanism, comprising a rotatory wire looping head provided with two sets of wire clamping and cutting devices located at opposite points on said head, the shearing member of each serving to sever the wire between the clamping jaw and the loop formed in the wire.

20. A wire tying mechanism, comprising a rotatary wire looping head provided with two oppositely located wire clamping and cutting devices, means to operate said clamping and cutting devices, whereby when one clamping device is closed the opposite shear is open, and when said clamping device is open the opposite shear is closed.

21. A wire tying mechanism, comprising a rotary wire looping head having a base plate provided with oppositely disposed hook members thereon, two annular plates mounted concentrically therewith, each having a portion of its periphery cut away to form clamping faces and cutting edges, the plates being oppositely arranged with respect to each other, and means for moving each of said plates in either direction relative to the other members.

22. A wire tying mechanism, comprising a rotatory looping head provided with oppositely arranged clamping and cutting devices on each side thereof, and a rotatory twisting head to engage and twist the loop formed by the looping head, the axes of rotation of said looping and twisting heads being substantially at right angles to each other.

23. A wire tying mechanism, comprising a rotatory looping head, a hollow trunnion upon which the same is mounted, means for clamping the wire in said looping head, a rotatory twisting head disposed within the hollow trunnion of the looping head, the axes of rotation of said heads being substantially at right angles to each other, and independent means for operating the looping and twisting heads.

24. A wire tying mechanism, comprising a rotatory looping head, a hollow trunnion on which said head is mounted, means for clamping the wire at opposite sides of said head, a rotatory twisting head disposed within the trunnion of the looping head and having a projecting pin about which the ends of the wires are looped, the axes of rotation of said heads being substantially at right angles to each other, and means for successively operating the looping head and the twisting head.

25. A wire tying mechanism, comprising a rotatory looping head, means to attach the wire thereto, a hollow stationary trunnion upon which said head is mounted, and wire twisting mechanism located in said hollow trunnion.

26. A wire tying mechanism, comprising a rotatory looping head, a hollow stationary trunnion therefor, a rotatory twisting head within the hollow trunnion having its axis of rotation disposed substantially at right angles to that of the looping head, and means for successively operating the looping and twisting heads.

27. A wire tying mechanism, comprising a rotatory looping head having wire clamping and cutting jaws disposed on opposite edges thereof, a hollow trunnion upon which said looping head is mounted, a twister head located within the hollow trunnion and having an axis of rotation substantially at right angles to the axis of said trunnion, said twister head having a segmental transverse groove and a looping pin projecting therefrom, means for successively operating the looper head and the twister head, and means for clamping the wires behind the loops during the operation of the twister head.

28. A wire tying mechanism, comprising a rotatory looping head, having wire clamping and wire cutting mechanism on each side thereof, a hollow trunnion upon which said looping head is mounted, a reciprocatory frame located within the trunnion, a rotatory twister head journaled in said frame and having its axis of rotation at right angles to that of the looping head, said twister head having a transverse groove or recess in one edge thereof and a pin projecting through said recess to receive the wires from the looping head, clamping jaws

mounted adjacent the twisting head and adapted to be operated by the frame to force the looped wires in the recess of the twister head, and means for successively operating the looping and twisting heads.

29. A wire tying mechanism, comprising a rotatory pin, means to form a double interlocking loop around said pin and hold the wire behind said loops, and means to revolve said pin transversely of the loops to twist the strands of the wire behind each loop together.

30. A wire tying mechanism, comprising a rotatory pin, a rotatory head adapted to form two interlocking loops of wire about said pin, means to hold the wire behind the loops, and means for successively operating the looping head and the twisting pin.

31. A wire tying mechanism, comprising a rotatory pin, a rotatory head adapted to form two interlocking loops of wire about said pin, wire clamping and cutting devices on opposite sides of said looping head, means to successively operate the looping head and rotatory pin to loop the wire about the pin and twist the looped portions, and means to actuate a cutting device to sever the wire behind one of said loops.

32. A wire tying mechanism, comprising a rotatory segmentally recessed twisting head, a pin carried by said head and projecting radially through the recess and beyond the periphery of said head, means to form loops of wire about said pin, and means to rotate said twisting head to twist the wire behind the loops.

33. A wire tying mechanism, comprising a rotatory segmentally recessed twisting head, a spring pressed pin slidably mounted in said head and projecting radially through the recess and beyond the periphery of said head, means to form loops of wire about said pin, and means to rotate said twisting head to twist the wire behind the loops.

34. A wire tying mechanism, comprising a rotatory segmentally recessed twisting head, a pin mounted in the recess in said head, clamping fingers mounted adjacent to said twisting head, means to rotate said twisting head, and means to actuate said fingers to force the wire looped about said pin into the recess in said head.

35. A wire tying mechanism, comprising a rotatory segmentally grooved twisting head, a pin mounted in the recess in said head, clamping fingers mounted adjacent the said twisting head, means to loop the wire about said pin, means to operate the clamping fingers to force the wire into the segmental groove and subsequently retract said fingers, and means to rotate said twisting head.

36. A wire tying mechanism, comprising a rotatory wire looping head, means to secure the wire at opposite points of said head, means to effect a complete revolution of the head to loop the wire, and means to effect a half revolution of the head in the opposite direction to release the wire after it has been twisted.

37. A wire tying mechanism, comprising a rotatory wire looping head, means to secure the wire at opposite points of said head, a rack to drive said head one revolution to loop the wire, and a second rack to drive the head one-half revolution in the opposite direction to release the wire.

38. A wire tying mechanism, comprising a rotatory wire looping head, a rotatory wire twisting head coöperating therewith, means to turn the looping head through a single revolution to loop the wire, means to rotate the twisting head, and means to turn the looping head one-half revolution in the opposite direction to shear and release the wire.

39. A baling press, comprising wire tying mechanism having a rotatory looping head, and a pivotally mounted finger adjacent said looping head to guide the wire against the face of the looping head.

40. A baling press, comprising a wire tying mechanism having a rotatory wire looping head, a pivotally mounted finger adjacent said looping head, a roller mounted on said finger to guide the wire against the face of the looping head, means to operate said finger to release the wire after it is tied.

41. A wire tying mechanism, comprising a rotatory twisting head having a segmental groove extending transversely thereof, gear teeth on the periphery of said head, and two driving gears coöperating with said teeth whereby one of said gears is always in engagement with the teeth on the head.

In testimony whereof we affix our signatures, in presence of two witnesses.

RICHARD A. CASWELL.
CHARLES H. CASWELL.
WALLACE CASWELL.

Witnesses:
ERNEST C. HERRICK,
HOMER G. PHIPPS.